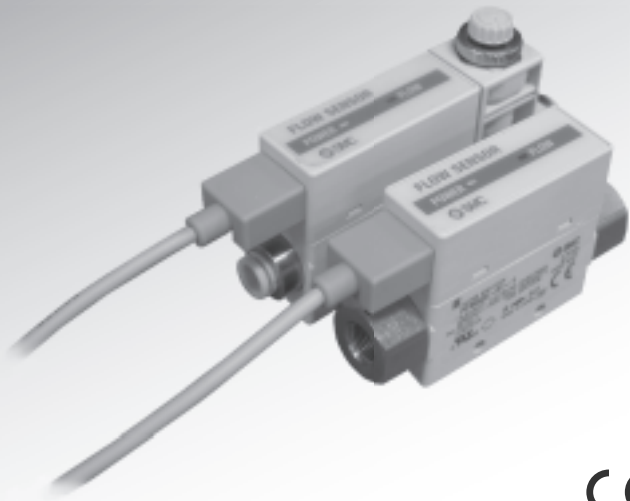


# Digital Flow Sensor Instruction Manual



PFM5□□ Series



**SMC Corporation**

URL <http://www.smcworld.com>

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Thank you for purchasing the SMC PFM5□□ Series Digital Flow Sensor.

Please read this manual carefully before operating the digital flow sensor and make sure you understand the digital flow sensor, its capabilities and limitations.

Please keep this manual handy for future reference.

## OPERATOR

- This manual has been written for those who have knowledge of machinery and apparatuses that use pneumatic equipment and have full knowledge of assembly, operation and maintenance of such equipment.
- Please read this manual carefully and understand it before assembling, operating or providing maintenance service to the flow sensor.

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To facilitate recycling, this manual is printed using biodegradable soy ink, which can easily be de-inked.



This manual is printed in the "non-water system", which does not output toxic liquid waste.

## Safety Instructions

The Digital Flow Sensor have in after referred to as flow sensor and this manual contain essential information for the protection of users and others from possible injury and property damage and to ensure correct handling.

Please check that you fully understand the definition of the following messages (signs) before going on to read the text, and always follow the instructions.

### IMPORTANT MESSAGES

Read this manual and follow its instructions. Signal words such as WARNING, CAUTION and NOTE, will be followed by important safety information that must be carefully reviewed.

#### **⚠WARNING**

Indicates a potentially hazardous situation which could result in death or serious injury if you do not follow instructions.

#### **⚠CAUTION**

Indicates a potentially hazardous situation which if not avoided, may result in minor injury or moderate injury.

#### **NOTE**

Gives you helpful information.

### **⚠WARNING**

**Do not disassemble, modify (including change of printed circuit board) or repair.**

An injury or failure can result.

**Do not operate outside of the specification.**

Fire, malfunction or flow monitor damage can result. Please use it after confirming the specification.

### **⚠WARNING**

**Do not operate in an environment of inflammable, explosive or corrosive gas.**

Fire or an explosion can result.

This flow monitor is not an explosion proof type.

**To avoid fire and explosion, Do not use the product for flammable fluid.**

This flow sensor is designed for air. Only dry air, N<sub>2</sub>, CO<sub>2</sub>, Ar are applicable.

**Do not use this product near by a place where static electricity is a problem.**

Otherwise it can cause failure or malfunction of a system.

**These instructions must be followed while in maintenance ; Turn off the power supply, stop the supplied air, exhaust the residual pressure and verify the release of air before performing maintenance.**

Otherwise it can cause injury.

### **⚠CAUTION**

**To avoid electric shock, malfunction, and switch damage, Do not touch live terminal nor connector.**

## ⚠ CAUTION

### Perform proper functional checks and leak tests after maintenance.

Stop operation when an abnormality is observed such that the flow sensor does not work properly or there is a leakage of fluid.

Safety is not be assured due to unexpected malfunction.

When leakage occurred from other parts except piping, the flow sensor might break.

Cut off power supply and stop supplying pressure. Don't apply pressure at leaking condition.

### Precaution on Handling

Use UL approved product for direct current power supply.

#### 1. Clamping voltage current circuit complies with UL508

Circuit which power supply if insulation transducer satisfying following conditions

Max. voltage (No load) : 30Vrms (42.4V peak) or less

Max. current : (1) 8A or less (Including short circuit)

(2) When limited by the circuit protector (fuse etc.) with the ratings in the table below.

Voltage without load (V peak)	Max. current rating (A)
0 to 20 [V]	5.0
Over 20 [V] up to 30 [V]	100/peak voltage

2. Circuit (of class 2) which is of 30Vrms (42.4V peak) or less with the power supply unit of class 2 complying with UL1310 or transducer of class 2 complying with UL1585.

### NOTE

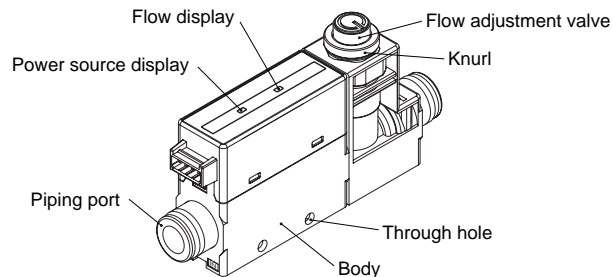
Follow the instructions given below when handling the flow sensor. Otherwise, the flow sensor may be damaged or may fail, thereby resulting in malfunction.

- Make sure to use a sensor by the specified voltage.
- Make sure to use specified measurement flow and operating pressure.
- Confirm the pressure loss at the sensor according to the flow characteristic (Pressure loss) graph for designing piping.
- Prepare maintenance space.
- Do not drop or bump, or apply excess impact (490mm/s<sup>2</sup>).
- Do not pull the lead wire forcefully, not lift the product by pulling the lead wire. (Tensile force 49N or less).
- Mount a sensor by observing the proper tightening torque.
- For piping of the flow sensor, hold the piping with spanner on the metal part of the piping (Piping attachment).
- Install or connect the flow sensor so that the flow direction specified on the label matches with actual flow direction.
- Pipe the flow sensor after eliminating dust in piping by air blow to avoid failure and malfunction.
- Never mount a sensor in a place that will be used as a scaffold during piping.
- Use dry air which complies with the quality grade of ISO 8573-1 1.1.2 to 1.6.2 : 2001.
- If the entering of foreign material to the fluid is possible, install and pipe the filter or the mist separator to the inlet to avoid failure and malfunction.
- Avoid repeatedly bending or stretching the lead wire.
- Wire correctly.
- Do not wire while the power is supplied.
- Do not wire in conjunction with power lines or high voltage lines.
- Confirm proper insulation of wiring.

## NOTE

- Wire as short as possible to avoid the affect of noise and surge.
- Never use in the presence of explosive gases.
- Do not use in an area where magnetic field is generated to avoid malfunction of sensor.
- Do not operate where the flow sensor is exposed to water.
- Do not use in an area containing oil or chemicals.
- Do not apply heat cycle to the flow sensor.
- Do not used in an area where surges are generated.
- Sensors are not equipped with surge protection against lightning.
- Do not use load generate surge voltage.
- Avoid foreign material such as wiring chips in the product.
- Avoid using sensors in an environment where the likelihood of splashing or spraying of water, chemicals, and oil to avoid failure and malfunction.
- Consider operating environment according to protection class.
- Do not mount the flow sensor where vibration ( $98\text{m/s}^2$  or less) and impact ( $490\text{m/s}^2$  or less) do not exist to avoid failure and malfunction.
- Operation under low temperature ( $5^\circ\text{C}$  or less) leads to cause damage or operation failure due to frozen moist in the fluid or air.
- Do not short circuit the load.
- Supply power when there is no flow.
- The flow sensor is compulsory turned off for 3s after power supplied.
- Maintenance and inspection should be performed periodically.
- Analogue output may fluctuate by 2 to 3% for 10 minutes after supplying power to the flow sensor.
- Do not poke inside a piping port with a stick.
- A flow rate of the flow sensor, which has a restrictor, may change if the needle turns due to vibration.
- The accuracy may fluctuate by 2 to 3% if a customer removes or replaces piping by themselves.
- When the product is fixed with a screw using the through hole, please tighten it with a  $0.3\text{Nm} \pm 0.05$  or less of tightening torque. (Excessive tightening may break the product.)

## Names and Functions of Individual Parts



Power source display (green) : Turns on when power is supplied.

Flow display (green) : Flashing interval depends on the flow value.

As flow increases, flash interval is shortened.

The light turns to red when rated flow is exceeded.

Body : Flow sensor itself.

Flow adjustment valve : Orifice mechanism to adjust the flow.

Piping port : Connect port of piping.

Knurl : Used to fix the needle.

Through hole : Used to mount the flow sensor on a DIN rail or a panel directly.

# Model Indication Method

PFM 5 □ □ - □ □

Type

Model	Contente
5	Separate type sensor part

Rated flow range (flow range)

Model	Contente
10	0.2 to 10(5)ℓ/min
25	0.5 to 25(12.5)ℓ/min
50	1 to 50(25)ℓ/min
11	2 to 100(50)ℓ/min

Note 1) Value in ( ) is the flow rate when CO<sub>2</sub> is used.

Flow adjustment valve

Model	Contente
Nil	No valve
S	Valve

Thread type (Connect port)

Model	Contente	Flow range			
		10	25	50	11
01	Rc1/8	○	○	○	
02	Rc1/4				○
N01	NPT1/8	○	○	○	
N02	NPT1/4				○
F01	G1/8	○	○	○	
F02	G1/4				○
C4	φ4 (5/32") One-touch fitting	○			
C6	φ6 One-touch fitting	○	○	○	○
C8	φ8 (5/16") One-touch fitting		○	○	○
N7	φ1/4 One-touch fitting		○	○	○

Piping inlet

Model	Contente
Nil	Straight direction
L	Back

- □ □ - □ □ □

Option2

Refer to the following table.

Option1

Model	Contente
Nil	Connector lead wire is included (2m)
W	Connector lead wire is included (2m) + Rubber cover
Z	No option

Proofreading certificate

Model	Contente
Nil	Without proofreading certificate
A	With proofreading certificate Note 2)

Note 2) Written in Japanese and English together. Other language is available as special request.

Operation manual

Model	Contente
Nil	With operation manual (Booklet:in Japanese and English)
N	Without operation manual

Output specification

Model	Contente	Applicable model
1	Analog (1 to 5V)	PFM30□ series
2	Analog (4 to 20mA)	PFM31□ series

Lead wire with a connector (2m) is attached to the product.  
It can be ordered with a part No. ZS-33-D, when another one is required.

Option2

Model	Option parts	Part number of optional part alone	Applicable part number
Nil	No option	—	—
R	Bracket (Flow adjusting valve unnecessary, pipig on the rear surface)	ZS-33-M	PFM5□□-□□/PFM5□□(S)-□□-□
S	Bracket (With flow adjusting valve)	ZS-33-MS	PFM5□□□-□□-□
T	Panel mount adapter (Flow adjusting valve unnecessary)	ZS-33-J	PFM5□□□□□(L)-□
V	Panel mount adapter (With flow adjusting valve)	ZS-33-JS	PFM5□□□□□(L)-□

Note 3) When two or more options are necessary, please describe those alphabetically.

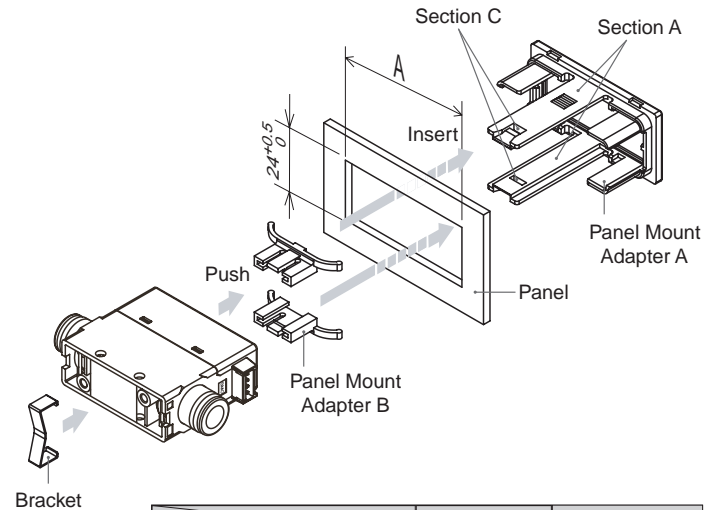
# Mounting and Installation

## ■ Installation

How to mount

### Panel Mount mounting

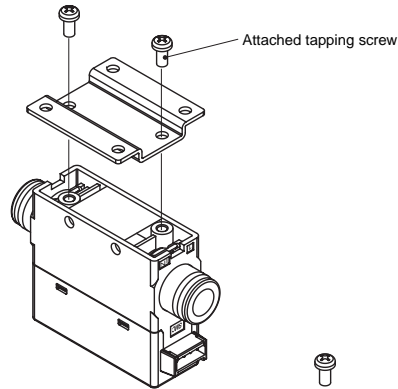
- Insert Panel Mount Adapter B supplied as an accessory into Section A of Panel Mount Adapter A.
- Push Panel Mount Adapter B from behind till the display is fixed onto the panel.
- The pin of Panel Mount Adapter B engages the notched part of Panel Adapter C to fix the display.
- The sensor can be mounted on a panel with a thickness of 1 to 3.2mm.
- See the illustration below for panel cut dimensions.



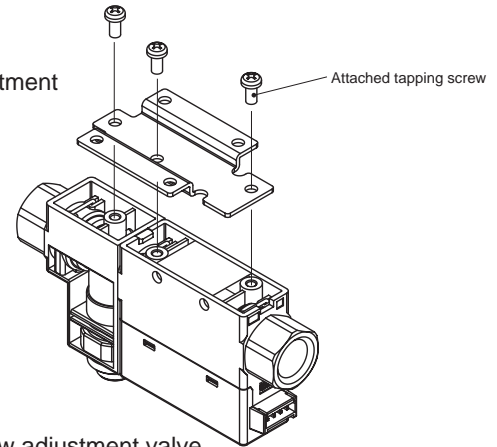
	Dimension A	Adaptor model
Without flow adjustment valve	$54^{+0.5}_0$	ZS-33-J
With flow adjustment valve	$74^{+0.5}_0$	ZS-33-JS

### bracket mounting

- Fasten the bracket mounting screws at a clamping torque of  $0.5 \pm 0.05$  N·m.



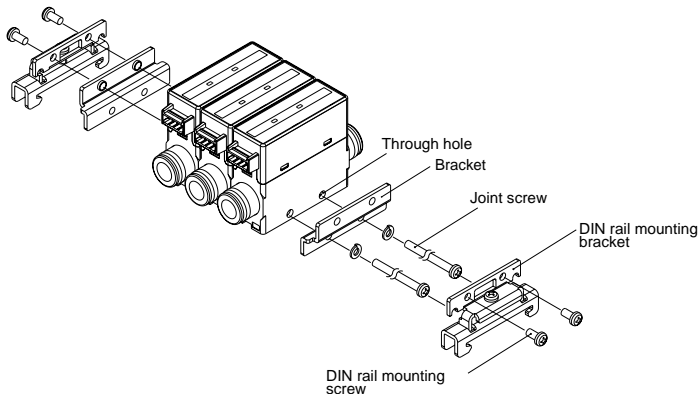
Without flow adjustment valve (using ZS-33-M)



With flow adjustment valve (using ZS-33-MS)

### DIN rail mounting (using ZS-33-R)

- The tightening torque for DIN rail mounting screws and joint screws should be  $0.4 \pm 0.05\text{N}\cdot\text{m}$ .

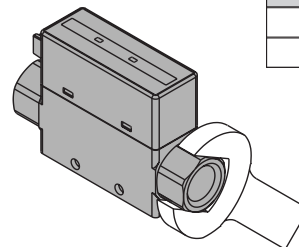


Note) Not applicable if the thread type is F02.

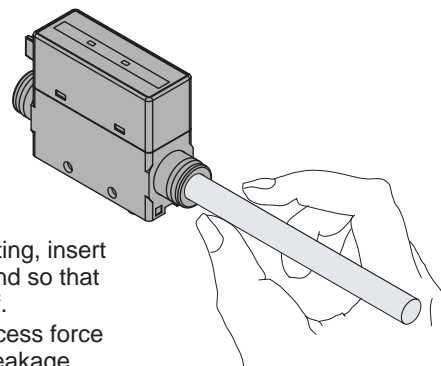
### ■ Piping

- Keep the tightening torque when piping for the female thread.
- Refer to the following table for the appropriate torque values.

Nominal size of screws	Appropriate torque N·m
Rc1/8	7 to 9
Rc1/4	12 to 14



- Hold the metal part with the spanner when piping.



- For one-touch fitting, insert the tube to the end so that it is not pulled off.
- Insertion with excess force lead to cause breakage.
- Ensure no leakage after piping.
- Use this flow sensor within the specified operating pressure range and operating temperature range.
- Withstand pressure are 1.0MPa.



## ■ Wiring

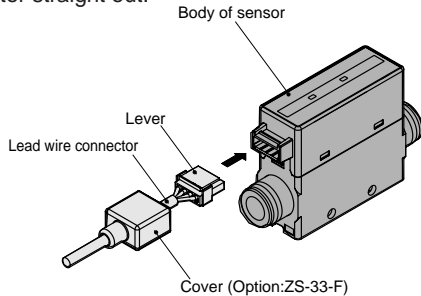
### Connection

- Make connection after turning the power off.
- Use a separate route when installing wire.  
Malfunction stemming from noise may occur if wire is installed in the same route as that of power or high-voltage cable.
- Be sure to ground terminal FG when using a switching regulator obtained on the market. If analog output is performed connecting to a switching regulator obtained on the market, switching noise will be superimposed and product specification can no longer be met. This can be prevented by inserting a noise filter, such as a line noise filter and a ferrite element, between the switching regulator and the sensor, or by using a seriespower supply instead of a switching regulator.

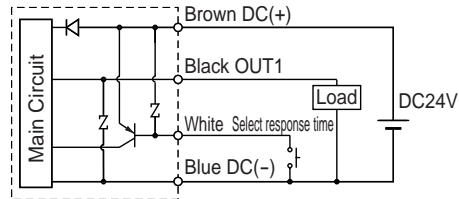
### Connector

#### Connector Connecting / Disconnecting

- When connecting the connector, insert it straight onto the pin holding the lever and connector body between fingers and lock the connector by pushing the lever claw into the square groove in the body of sensor.
- When disconnecting the connector, push down the lever by thumb to disengage the lever claw from the square groove. Then pull the connector straight out.



### Output circuit



Analog output 1 to 5V      Analog output 4 to 20mA  
 Output impedance 1kΩ      Load impedance 50 to 600Ω  
 External input : No voltage input  
                          Reed switch or solid state switch input  
                          30ms or more

### ■ Select response speed

- To reduce ripple by slowing the response speed when ripple of analog output is large due to the effect of pulsation.



### How to select

- Connect input line(white) to GND. While connected, response speed is 1.0s. (50ms when not input)

## Error Indication

### Error indication function

This function is to display error location and content when a problem or an error occurs.

Error Name	Error Display	Error Content	Troubleshooting
<b>Flow error</b>	 Flow display lamp is red.	Flow exceeds rated flow range.	Apply flow within rated flow range.
<b>System Error</b>	 Power supply display lamp is red.	System error. Possible damage of internal circuit.	Turn off the power supply once, and then, supply the power again. If error is not released by this, please contact SMC sales office.

If the above remedy can't recover the operation, the error needs to be investigated by SMC.